

APPENDIX F

AIR QUALITY CONSTRUCTION EMISSIONS CALCULATIONS

This appendix includes copies of the calculations backup by year. A quantitative construction-related impact evaluation for the proposed Gary/Chicago International Airport construction activities was conducted for all construction modules during scheduled construction years 2005, 2006, and 2007, respectively, to evaluate pollutant emissions and air quality conformity.

EPA NONROAD Model
Indiana State Construction Equipment
Year 2008 Emission Factor Calculation

Gary Airport Construction Activities
Calculation Of Equipment Hourly Emission Factor (g/hour-operated)

Equipment Type	EPA SIC Code	Indiana State Equipment Inventory			SIC Average Activity/Equip (hr/year)			Indiana State Emission (tons/year) Per SIC				Calculated Unit Emission Factors (g/hr-hr)				Equipment Type	Estimated On-Site Const. Engine HP	Construction Equipment Hourly Emission Factors (g/hour-operated)					
		HP Range	Population	Avg HP		VOC	NOx	CO	PM10	PM2.5	SOx	VOC	NOx	CO	PM10			PM2.5	SOx				
triple dump truck	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	54.73	1,253.33	444.20	65.17	81.28	197.32
hydraulic excavator	2270002036	175 ~ 300	917	238	1662	14.14	362.79	135.42	40.84	4.50	11.22	0.16	3.20	1.16	0.17	0.17	0.44	85.05	890.57	238.50	58.48	54.38	139.53
dozer	2270002066	300 ~ 600	481	450	998	39.13	692.79	284.43	40.94	34.63	91.13	0.18	3.20	1.33	0.19	0.18	0.43	79.95	925.00	312.46	51.24	47.06	101.96
tractor loader	2270002096	100 ~ 175	2772	138	1135	124.98	713.32	480.25	80.40	37.66	91.13	0.16	3.20	1.33	0.16	0.15	0.43	42.10	570.30	156.39	38.34	36.27	88.49
motor grader	2270002048	175 ~ 300	575	238	1641	30.48	418.73	113.24	27.76	25.54	79.79	0.26	1.49	1.03	0.17	0.15	0.43	37.86	491.64	132.95	30.54	28.77	63.48
off-road water wagon	2270002051	175 ~ 300	47	238	1641	4.38	56.75	15.34	3.57	3.32	9.63	0.22	2.81	0.78	0.19	0.18	0.44	37.86	491.64	132.95	30.54	28.77	63.48
627 scraper	2270002018	300 ~ 600	167	238	914	22.13	387.05	163.88	23.84	22.02	51.43	0.22	3.12	0.85	0.21	0.19	0.47	51.07	701.00	181.49	45.45	42.79	106.53
515 compactor	2270002015	16 ~ 25	10	21	484	0.05	0.26	0.16	0.03	0.03	0.03	0.45	2.33	1.43	0.27	0.27	0.27	33.00	1,015.51	430.24	62.81	57.77	134.94
Vol. Roller	2270002038	175 ~ 300	131	238	1641	5.05	68.77	18.93	1.69	1.69	4.44	0.16	2.33	1.43	0.27	0.27	0.27	98.99	511.61	314.84	59.03	59.03	95.03
tree chipper	2270002034	300 ~ 600	82	450	1641	0.24	23.08	10.97	1.85	1.85	3.38	0.36	3.51	1.47	0.27	0.25	0.44	48.44	659.03	191.94	44.70	41.13	96.30
hydraulic excavator	2270002036	175 ~ 300	917	238	1662	14.14	362.79	135.42	40.84	4.50	11.22	0.16	3.20	1.16	0.17	0.17	0.44	35.93	853.33	242.00	57.25	53.93	120.93
off-road dump truck	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	42.83	1,185.23	418.55	66.05	65.69	237.87
excavator (trac)	2270002036	175 ~ 300	917	238	1662	14.14	362.79	135.42	40.84	4.50	11.22	0.16	3.20	1.16	0.17	0.17	0.44	42.83	1,185.23	418.55	66.05	65.69	237.87
work train (rail work)	2270002081	300 ~ 600	158	450	1641	14.30	188.81	98.52	14.74	13.56	21.22	0.30	3.98	2.08	0.31	0.28	0.45	49.56	676.53	179.43	44.56	41.00	106.31
mobile crane	2270002042	300 ~ 600	106	450	1641	7.84	125.86	34.70	6.76	6.22	14.23	0.15	2.42	0.67	0.13	0.12	0.29	75.43	986.63	519.67	77.75	71.53	111.93
concrete batch plant	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	60.37	986.63	267.20	52.05	47.50	109.53
concrete haul truck	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	85.64	928.85	362.32	75.05	72.46	79.05
concrete mix truck	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	54.73	1,253.33	444.20	65.17	58.48	197.32
concrete pump truck	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	54.73	1,253.33	444.20	65.17	58.48	197.32
concrete pump truck	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	54.73	1,253.33	444.20	65.17	58.48	197.32
line truck (class I)	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	38.07	1,871.88	305.41	45.33	42.83	137.25
auger truck (class I)	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	54.73	1,253.33	444.20	65.17	61.28	197.32
line truck (class II)	2270002051	300 ~ 600	134	450	1641	12.95	296.57	105.11	15.42	14.50	46.69	0.12	2.72	0.97	0.14	0.13	0.43	54.73	1,253.33	444.20	65.17	61.28	197.32
concrete slip form paver	2270002021	100 ~ 175	56	138	522	1.59	19.04	7.70	1.46	1.34	2.46	0.30	3.60	1.46	0.28	0.25	0.47	57.60	792.93	222.75	53.09	48.37	118.03
concrete finisher	2270002021	100 ~ 175	56	138	522	1.59	19.04	7.70	1.46	1.34	2.46	0.30	3.60	1.46	0.28	0.25	0.47	52.62	630.17	254.85	46.32	44.35	81.45

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Equipment Type	EPA SIC Code	Indiana State Equipment Inventory		SIC Average Activity/Equip (hour/year)	Indiana State Emission (ton/year) Per SIC					Calculated Unit Emission Factors (g/hr-hour)					Equipment Type	Estimated On-Site Const. Engine HP	Construction Equipment Hourly Emission Factors (g/hour-operated)						
		HP Range	Population		VOC	NOx	CO	PM10	PM2.5	SOx	VOC	NOx	CO	PM10			PM2.5	SOx					
tri-axle dump truck	2270002051	300 ~ 600	138	450	1641	12.68	277.78	101.25	15.90	14.67	47.85	0.11	2.48	0.90	0.14	0.13	0.43	52.03	1,139.90	415.49	64.02	60.20	196.38
hydraulic excavator	2270002036	175 ~ 300	840	238	1092	51.71	689.50	195.02	47.89	44.83	119.02	0.16	2.60	0.73	0.18	0.17	0.44	60.61	618.76	229.77	56.25	52.31	139.51
dozer	2270002069	300 ~ 600	472	450	1936	35.47	651.84	265.69	39.07	33.94	93.42	0.16	2.98	1.21	0.16	0.16	0.43	60.61	618.76	229.77	56.25	52.31	139.29
track loader	2270002066	100 ~ 175	2841	138	1135	120.90	703.08	471.57	78.03	72.57	87.80	0.25	1.44	0.96	0.18	0.18	0.17	39.41	408.29	283.94	48.62	44.22	50.97
motor grader	2270002045	175 ~ 300	589	238	1682	29.23	398.08	112.11	27.42	25.50	65.85	0.20	2.69	0.76	0.18	0.17	0.44	39.41	438.09	370.55	48.62	44.22	50.97
off-road water wagon	2270002045	175 ~ 300	48	238	1641	4.07	51.18	15.75	3.47	3.19	9.87	0.20	2.69	0.76	0.18	0.17	0.44	39.41	438.09	370.55	48.62	44.22	50.97
827 scraper	2270002018	300 ~ 600	171	238	914	8.71	118.70	33.57	8.15	7.58	19.40	0.21	2.90	0.62	0.20	0.19	0.47	34.54	434.33	133.66	29.45	27.07	83.76
815 compactor	2270002039	18 ~ 25	285	450	314	20.26	370.74	153.81	22.84	21.24	52.72	0.16	2.68	1.19	0.16	0.16	0.41	47.89	652.71	184.60	44.82	41.68	106.68
vib. Roller	2270002015	175 ~ 300	134	238	760	4.85	66.09	19.40	4.59	4.27	10.20	0.18	2.48	0.73	0.17	0.16	0.39	51.90	946.83	393.64	56.45	54.36	134.93
tree chopper	2270002030	100 ~ 175	84	138	593	2.14	25.24	10.11	1.95	1.81	3.37	0.28	3.34	1.34	0.26	0.24	0.45	45.48	619.71	181.91	43.04	40.04	98.49
off-road dump truck	2270002051	300 ~ 600	138	450	1641	12.68	277.78	101.25	15.90	14.67	47.85	0.11	2.48	0.90	0.14	0.13	0.43	52.03	1,139.90	415.49	64.02	60.20	196.38
excavator (rail work)	2270002036	175 ~ 300	940	238	1692	51.71	689.50	195.02	47.89	44.83	119.02	0.16	2.60	0.73	0.18	0.17	0.44	46.16	633.62	179.06	42.86	39.86	106.29
work train (rail work)	2270002045	300 ~ 600	109	450	690	7.40	122.05	33.45	6.52	6.06	14.59	0.14	2.28	0.53	0.12	0.11	0.27	66.45	844.13	479.32	71.41	66.42	111.69
mobile crane	2270002045	300 ~ 600	109	450	690	7.40	122.05	33.45	6.52	6.06	14.59	0.14	2.28	0.53	0.12	0.11	0.27	55.41	913.87	250.49	48.82	45.38	109.26
concrete batch plant	2270002042	100 ~ 175	10	138	275	0.13	1.41	0.65	0.12	0.11	0.12	0.31	3.38	1.32	0.28	0.26	0.29	55.41	913.87	250.49	48.82	45.38	109.26
concrete mix truck	2270002051	300 ~ 600	138	450	1641	12.68	277.78	101.25	15.90	14.67	47.85	0.11	2.48	0.90	0.14	0.13	0.43	65.64	926.85	362.32	76.05	72.48	178.05
concrete pump truck	2270002051	300 ~ 600	138	450	1641	12.68	277.78	101.25	15.90	14.67	47.85	0.11	2.48	0.90	0.14	0.13	0.43	52.03	1,139.90	415.49	64.02	60.20	196.38
concrete mixer truck	2270002051	175 ~ 600	181	344	1841	16.75	328.96	117.00	19.07	17.74	57.72	0.15	2.93	1.04	0.17	0.16	0.51	52.03	1,139.90	415.49	64.02	60.20	196.38
line truck (class I)	2270002051	300 ~ 600	138	450	1641	12.68	277.78	101.25	15.90	14.67	47.85	0.11	2.48	0.90	0.14	0.13	0.43	36.20	792.87	269.04	44.53	42.82	106.36
line truck (class II)	2270002051	300 ~ 600	138	450	1641	12.68	277.78	101.25	15.90	14.67	47.85	0.11	2.48	0.90	0.14	0.13	0.43	36.20	792.87	269.04	44.53	42.82	106.36
line truck (class II)	2270002051	300 ~ 600	138	450	1641	12.68	277.78	101.25	15.90	14.67	47.85	0.11	2.48	0.90	0.14	0.13	0.43	36.20	792.87	269.04	44.53	42.82	106.36
concrete slip form paver	2270002003	175 ~ 300	98	238	821	3.43	46.82	13.42	3.22	3.00	7.45	0.16	2.22	0.64	0.15	0.14	0.35	54.55	744.62	213.43	51.21	47.71	116.48
concrete finisher	2270002021	100 ~ 175	57	138	922	1.54	18.51	7.11	1.41	1.30	2.92	0.29	3.44	1.32	0.26	0.24	0.47	50.05	601.88	231.19	45.85	42.27	81.94

Gary Airport Construction Emission Calculation
Year 2006 Emission Burden

<u>Module</u>	Total Construction Emission Burden (tons) For This Module						% Work Scheduled in 2006
	VOC	NOx	CO	PM10	PM2.5	SOx	
1	0.000	0.000	0.000	0.000	0.000	0.000	0%
2	0.000	0.000	0.000	0.000	0.000	0.000	0%
3	0.000	0.000	0.000	0.000	0.000	0.000	0%
4	0.168	2.412	0.907	0.164	0.153	0.363	60%
5	0.000	0.000	0.000	0.000	0.000	0.000	0%
5A	0.590	9.033	3.239	0.578	0.539	1.334	65%
6	0.000	0.000	0.000	0.000	0.000	0.000	0%
7A	0.219	3.887	1.389	0.239	0.223	0.629	40%
7B	0.032	0.545	0.197	0.034	0.032	0.087	20%
8	0.000	0.000	0.000	0.000	0.000	0.000	0%
9	0.000	0.000	0.000	0.000	0.000	0.000	0%
10	0.059	0.869	0.304	0.053	0.050	0.121	40%
11	0.101	1.398	0.609	0.101	0.094	0.198	40%
Summary (tons)	1.169	18.144	6.646	1.169	1.091	2.733	
5	0.381	5.992	2.102	0.374	0.349	0.880	60%

EPA NONROAD Model
Indiana State Construction Equipment
Year 2007 Emission Factor Calculation

Gary Airport Construction Activities
Calculation Of Equipment Hourly Emission Factor (g/hour-operated)

Equipment Type	EPA SIC Code	HP Range	Indiana State Equipment Inventory Population	Avg. HP	SIC Average Activity/Equip. (hour/year)	Indiana State Emission (tons/year) Per SIC					Calculated Unit Emission Factors (g/hr-hr)					Equipment Type	Estimated On-Site Const. Engine HP	Construction Equipment Hourly Emission Factors (g/hour-operated)						
						VOC	NOx	CO	PM10	PM2.5	SOx	VOC	NOx	CO	PM10			PM2.5	SOx					
tri-axle dump truck	2270002051	300 ~ 600	141	450	1841	12.51	258.12	98.03	15.36	15.00	49.01	0.11	2.25	0.86	0.13	0.13	0.43	460	50.24	1,036.68	393.72	61.69	60.24	196.84
hydraulic excavator	2270002036	175 ~ 300	983	238	1002	49.53	657.95	198.03	47.38	43.99	121.93	0.18	2.39	0.72	0.17	0.16	0.44	315	56.67	752.61	228.58	94.21	48.87	139.51
dozer	2270002058	300 ~ 600	464	450	1306	18.00	454.71	165.03	77.49	74.49	83.81	0.24	1.15	0.11	0.17	0.15	0.43	305	41.63	541.55	163.16	37.15	48.35	145.91
truck loader	2270002048	175 ~ 300	260	238	1335	11.62	69.60	24.71	77.74	24.67	67.28	0.22	1.35	0.91	0.15	0.11	0.47	200	71.21	148.30	277.22	27.15	4.38	52.91
off-road water wagon	2270002051	175 ~ 300	603	238	1642	23.07	376.13	117.88	27.14	24.67	67.28	0.18	2.49	0.74	0.18	0.16	0.44	175	36.87	487.68	147.47	35.74	32.88	99.60
627 scraper	2270002018	175 ~ 300	175	238	914	8.37	112.85	33.43	8.06	7.42	19.67	0.20	2.70	0.80	0.19	0.18	0.47	225	44.87	606.90	178.62	43.31	39.87	106.76
821 scraper	2270002016	300 ~ 600	292	450	914	18.45	352.24	143.31	21.79	20.05	54.01	0.14	2.67	1.08	0.16	0.15	0.41	330	46.09	879.87	357.98	54.43	50.08	134.91
815 compactor	2270002039	18 ~ 25	21	21	484	0.04	0.25	0.15	0.03	0.03	0.03	0.36	2.24	1.34	0.27	0.27	0.27	220	78.71	491.93	285.16	59.03	59.03	59.03
vib. roller	2270002015	100 ~ 175	137	238	760	4.88	63.88	19.05	4.53	4.21	10.54	0.17	2.33	0.70	0.17	0.15	0.39	250	42.92	583.12	174.72	41.55	38.61	96.67
tree chopper	2270002035	100 ~ 175	86	138	583	2.01	24.17	9.36	1.92	1.71	3.45	0.28	3.12	1.21	0.25	0.25	0.39	320	31.16	374.88	143.40	29.76	27.44	93.48
hydro sweeper	2270002024	300 ~ 600	141	450	1841	12.51	258.12	98.03	15.36	15.00	49.01	0.11	2.25	0.86	0.13	0.13	0.43	360	39.32	811.32	308.13	48.26	47.15	154.05
excavator/truck	2270002036	175 ~ 300	963	238	1092	49.53	657.95	198.03	47.38	43.99	121.93	0.18	2.39	0.72	0.17	0.16	0.44	240	43.18	573.57	172.63	41.30	38.00	106.29
work train (rail work)	2270002081	300 ~ 600	186	450	606	12.86	178.84	59.75	13.42	12.35	22.28	0.26	3.59	1.80	0.27	0.25	0.45	250	64.56	886.88	450.60	87.38	62.00	111.86
mobile crane	2270002045	300 ~ 600	112	450	990	6.96	117.82	32.04	6.29	5.79	14.95	0.13	2.15	0.58	0.11	0.11	0.27	400	50.72	858.68	233.50	45.84	42.20	108.55
concrete batch plant	2270002042	100 ~ 175	10	138	275	0.13	1.41	0.55	0.12	0.11	0.12	0.31	3.38	1.32	0.29	0.26	0.29	275	65.64	928.85	362.32	79.05	72.46	78.05
concrete haul truck	2270002051	300 ~ 600	141	450	1841	12.51	258.12	98.03	15.36	15.00	49.01	0.11	2.25	0.86	0.13	0.13	0.43	460	50.24	1,036.68	393.72	61.69	60.24	196.84
concrete mix truck	2270002051	300 ~ 600	141	450	1841	12.51	258.12	98.03	15.36	15.00	49.01	0.11	2.25	0.86	0.13	0.13	0.43	460	50.24	1,036.68	393.72	61.69	60.24	196.84
concrete pump truck	2270002051	175 ~ 300	191	344	1641	16.29	365.73	114.23	19.56	18.35	59.12	0.14	2.58	0.96	0.16	0.15	0.50	380	49.45	928.08	348.72	61.37	55.70	179.45
line truck (class I)	2270002051	300 ~ 600	141	450	1841	12.51	258.12	98.03	15.36	15.00	49.01	0.11	2.25	0.86	0.13	0.13	0.43	320	34.55	721.17	273.89	42.81	41.51	136.93
super truck (class I)	2270002051	300 ~ 600	141	450	1841	12.51	258.12	98.03	15.36	15.00	49.01	0.11	2.25	0.86	0.13	0.13	0.43	460	50.24	1,036.68	393.72	61.69	60.24	196.84
line truck (class II)	2270002051	300 ~ 600	141	450	1841	12.51	258.12	98.03	15.36	15.00	49.01	0.11	2.25	0.86	0.13	0.13	0.43	460	50.24	1,036.68	393.72	61.69	60.24	196.84
concrete slip form paver	2270002003	175 ~ 300	100	236	821	3.31	44.86	13.30	3.19	2.93	7.64	0.15	2.09	0.62	0.15	0.14	0.36	335	51.59	699.18	207.29	49.72	45.67	119.08
concrete finisher	2270002021	100 ~ 175	56	138	622	1.44	17.64	6.55	1.39	1.28	2.58	0.26	3.22	1.20	0.25	0.23	0.47	175	46.02	583.70	209.31	44.42	40.50	82.45

Gary Airport Construction Emission Calculation
Year 2007 Emission Burden

<u>Module</u>	Total Construction Emission Burden (tons) For This Module						% Work Scheduled in 2007
	VOC	NOx	CO	PM10	PM2.5	SOx	
1	0.000	0.000	0.000	0.000	0.000	0.000	0%
2	0.000	0.000	0.000	0.000	0.000	0.000	0%
3	0.000	0.000	0.000	0.000	0.000	0.000	0%
4	0.052	0.747	0.285	0.052	0.049	0.121	20%
5	0.000	0.000	0.000	0.000	0.000	0.000	0%
5A	0.295	4.512	1.639	0.297	0.277	0.718	35%
6	0.132	2.258	0.812	0.144	0.137	0.409	100%
7A	0.310	5.363	1.971	0.344	0.326	0.945	60%
7B	0.120	2.012	0.750	0.132	0.125	0.349	80%
8	0.046	0.816	0.315	0.052	0.049	0.143	100%
9	0.178	3.047	1.123	0.197	0.188	0.545	100%
10	0.083	1.213	0.430	0.076	0.072	0.182	60%
11	0.000	0.000	0.000	0.000	0.000	0.000	0%
Summary (tons)	1.216	19.967	7.323	1.294	1.223	3.412	
5	0.236	3.702	1.316	0.238	0.222	0.586	40%